

Used Oil Curricula



# Every Drop Counts

Chula Vista Nature Center  
1000 Gunpowder Point Drive  
Chula Vista, CA 91910-1201  
(619) 422-2481

\$15.00. 1994. 54 p.

Designed for grades 4-6, *Every Drop Counts* integrates the recycling of used motor oil into the context of watershed and wetlands. The lessons are specific to San Diego County; the geographic features, waterways, and animal life mentioned in the material pertain to San Diego Bay and the surrounding environment. Some of the lessons could, however, be adapted to other regions, including the storm drain walk and water pollution experiment.



## REPORT CARD

Overall Grade	B
General Content	B+
Presentation	B
Pedagogy	A-
Teacher Usability	B
Used Oil	B-

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"This is a collection of activities to prepare students for a visit to a particular wetlands that must deal with 'oil spill realities'."

### Pedagogy

"The materials are 'choppy'."

"This is more a collection of activity packets than a full curriculum."

### Teacher Usability

"Very informative background section in the front of the curriculum."

"It would be helpful if this packet had a cover page listing each activity and its objectives."

### Specific Content

*Every Drop Counts* identifies lots of good community resources, but most are limited to the San Diego area."

"It is focused on the San Diego Bay, but other regions could use this as a model to create their own regional curriculum."

While the activities are interesting, there is little used oil content in them.

## TEACHER'S GUIDE TO THE WATER POLLUTION EXPERIMENT

Pollutants that enter San Diego Bay through urban runoff have different chemical and physical properties. The following experiment is designed to help students understand some of these differences, and how each could adversely affect living organisms.

**Time required:** This experiment extends over a 3-4 day period; day one requires 45 minutes to 1 hour; days two requires about 15 minutes and the last day about 1/2 hour. You may wish to start the experiment on a Thursday to give the weekend for the water to evaporate.

**Space requirement:** Room for the petri dishes to be left out for several days.

**Materials required** for each group (students can work in pairs or groups of four)

6 petri dishes	Food coloring*	Measuring spoons
Water Dirt*	Eye dropper	
Vegetable oil*	White Vinegar*	Masking tape or glass
Baking Soda	marking pen	

Each item marked with an \* represents a type of pollutant found in urban runoff. Vegetable oil represents motor oil; food coloring represents persistent pollutants whose toxicity often depends upon concentration, such as pesticides; dirt represents dirt and other particulate matter, such as rubber that wears off of tires; vinegar represents acids which may be found in pool chemicals or driveway cleaners — the toxicity of these also depends upon concentration, but they can be neutralized and generally do not persist in the environment. Vinegar also demonstrate that not all pollutants are visible.

Black line masters with instructions and space for observations are provided in the right hand pocket. However, you may prefer to have students prepare their own observation sheets which will allow them more space.

**Points of curriculum integration:** Food chains, requirements of life.

### Procedure:

Step 1. Students should mark the bottom of five petri dishes as follows: Vegetable Oil, Food coloring, Dirt, Vinegar, Control. The sixth petri dish will be used for testing on days two and three.

Step 2. Students should add ONE TABLESPOON of water to each of the oil, dirt, food coloring and control petri dishes. They should add 1-1/2 teaspoons of water to the vinegar petri dish. They should predict what will happen in step 3.

Chula Vista Nature Center 8/94  
From S.D. Watershed Protection Project

1.



## WATER POLLUTION EXPERIMENT - Day One Observation Sheet

NAME: \_\_\_\_\_

### Instructions:

1. Label five dishes as follows: Vegetable Oil, Food Coloring, Dirt, Vinegar, Control
2. Add 1 Tablespoon of water to each dish except the vinegar dish; add 1-1/2 teaspoons of water to the vinegar dish.
3. Predict what you think will happen to each dish if you add:
  - 3 drops of vegetable oil to the dish marked "oil"
  - 1 drop of food coloring to the dish marked "food coloring"
  - 1 teaspoon of dirt to the dish marked "dirt"
  - 1-1/2 teaspoons of vinegar to the dish marked "vinegar"
4. Add the above and observe what actually happens. How did your predictions compare to your observations?
5. Place your dishes in a safe place. Predict how each dish will look tomorrow.
6. Why do you need a "control" dish?

VEGETABLE OIL	FOOD COLORING	DIRT	VINEGAR	CONTROL
Prediction:				
Observation:				
Prediction:				

# Action for a Cleaner Tomorrow

South Carolina Department of Health and Environmental Control  
2600 Bull Street  
Columbia, SC 29201  
(800) 768-7348



No charge. 1998. 619 p.

Revised in 1998, *Action for a Cleaner Tomorrow* (grades 6-12 edition) address numerous issues including the environmental effects of solid waste, human population growth, manufacturing by-products, excessive packaging, and motor oil. Lessons are divided into two sections (grades 6-8 and 9-12) and are supported by an extensive resource section covering background information, glossary, and list of books and videos. One subsection focuses on recycling used oil and includes lessons that detail the proper way to collect and recycle engine oil, compute the energy savings from recycling oil, and analyze the effects of mismanaged used oil. Report card scores are directed at the 7-9 level for used oil.

## REPORT CARD

Overall Grade	B+
General Content	A-
Presentation	B+
Pedagogy	B+
Teacher Usability	B+
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

A cohesive and organized look at used oil issues.

### Presentation

Since this compendium project, *Action for a Cleaner Tomorrow* has been redesigned.  
"Nice presentation."

### Pedagogy

"[Used oil lessons] are brief."  
"Needs more labs and other science activities."

### Teacher Usability

"Needs to list lab time for activities."

### Specific Content

"Presents some good data on oil spills and how oil is recycled."

## Recycling Used Oil

Preparation Time:	Easy-to-do	Moderate	Extensive
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Grade:	9 - 12
Focus:	Used oil recycling, re-refining and energy recovery
Subject:	Social Studies, Science, Math
Materials:	Motor oil in a plastic container, an aluminum funnel and an oil filter in a paper bag, map of local area or county, sample electricity bill
Teaching Time:	One class period, plus student research
Vocabulary:	Reprocessing, energy recovery, re-refining

### Learning Objective

Students will:

- examine used oil, filter and bottle recycling;
- define the benefits of used motor oil recycling to their community;
- compute the potential energy savings from recycling used oil;
- research the logistics of recycling used oil, filters and bottles in their community.

### Background

Nationally, do-it-yourself oil changers generate more than 200 million gallons of used motor oil each year.

Forty percent of the oil pollution in America's waterways is from used automotive oil.

According to the American Petroleum Institute, it takes 42 gallons of crude oil - compared to just one gallon of used oil - to make 2 1/2 quarts of virgin lubricating oil.

The properties that make oil a valuable lubricant in your car's engine also make it ideal for recycling by re-refining. Used oil can be cleaned and used again as a lubricant or used as an energy source. Re-refining used oil is on the increase in the United States.

According to the United States Environmental Protection Agency (EPA), the vast majority of used oil collected is **reprocessed** - processed again - into fuel oil. Reprocessing involves removing impurities from the used oil and blending it with crude oil to make industrial grade heating fuel. Reprocessed used oil is often sold to industries such as asphalt plants, cement companies and steel mills at lower prices than the price of fuel oil made from virgin crude oil.

### Oil for Energy Recovery

In South Carolina, used oil that would otherwise be discarded illegally is now being collected and turned into energy.

In a process called **energy recovery**, much of South Carolina's used oil is burned as a fuel source in generating electricity. Resource recovery is the process of obtaining material or energy resources from solid waste which no longer has

9.OIL.1.F



The Exxon Valdez oil spill in 1989 killed 350,000 to 390,000 seabirds, according to the General Accounting Office report to Congress.

Source: 1993 Environmental Almanac

### On the Road Again

Beyond recycling used oil into heating fuel or burning it for energy recovery, advanced recycling methods **re-refine** used oil so that it can be reused as a lubricant.

Re-refining technology has improved over the past five years. According to the National Institute of Standards and Technology, re-refined lubricating oil meets the same standards as lubricating oil made from crude oil.

While re-refining used oil into lubricating oil is considered by many environmentalists as the preferred use of used oil, only a small percentage of used oil collected is re-refined.

According to a report by the Buy Recycled Business Alliance, "Mercedes Benz installs re-refined oil in every new car manufactured in Germany.

"Re-refined oil products today are subject to the same stringent refining, compounding and performance standards that apply to virgin oil products ... Although re-refined oil can meet all automobile warranty requirements that virgin oils do, concern about vehicle manufacturers voiding warranties if re-refined oils are used still persists.



In South Carolina, used oil that would otherwise be discarded illegally is now being collected and turned into effective energy.

This is not a legitimate concern if a quality re-refined oil is used. All three of the major U.S. automobile manufacturers (Ford, GM and Chrysler) now recognize that re-refined oils can meet the performance criteria specified in their warranties. Warranty requirements are based on performance criteria, not on the origin of the base oil."

The technology of re-refining is changing and keeping pace is expensive. Companies are also concerned about complying with environmental regulations. To be large enough to achieve economies of scale, re-refineries are getting larger. The largest oil re-refinery is owned by SafetyKleen Corporation. The 75-million gallon annual capacity facility in East Chicago cost the company \$50 million when it was built in 1991. SafetyKleen and Evergreen Oil currently re-refine used crankcase oil into lube oil. The other five re-refining companies produce fuel oils, gasoline and asphalt flux.

### Learning Procedure

1. Before reviewing the background information with the class, show students a bottle of ordinary motor oil in a plastic container, an aluminum funnel and an oil filter in a paper bag. Explain to students that these are just some of the items that you might use during a typical oil change.

**Ask:** From these items, what would you expect to be able to recycle? List student responses on the board. Students should consider that the plastic, aluminum and paper bag may be recyclable. Students may not think to include the motor oil, filter or empty motor oil bottle as recyclable items. If students do not mention the oil, filter or bottle, **ask:** What valuable natural resources were used in creating these items?

Students should mention the petroleum used to create the plastic bottle, the bauxite used to make the aluminum, the trees used to make the paper.

**Ask:** What about the petroleum used to make the motor oil? Is it a valuable resource like the petroleum used to make the plastic? Explain to

# Used Oil Recycling, A Complete Curriculum

Florida Department of Environmental Protection  
Hazardous Waste Management Section  
2600 Blair Stone Road  
Tallahassee, FL 32399  
(850) 488-0300



\$256.00 per kit. 1990. 115 p. teacher's guide.

Product is of limited availability. Permission is granted to educators to reproduce lesson plans for classroom use, provided credit is given to FDEP.

Designed for 7-12 grades, *Used Oil Recycling, A Complete Curriculum* offers a video, poster, used oil display, and teacher's guide with background information, transparency masters, student guide, and lesson plans organized by grade-group level. The material provides an overview of the used oil recycling process, including the formation, drilling, and refining of crude oil, economic and environmental issues of disposal practices, and the collection, transportation, reclamation, and reuse of used oil. Report card scores are directed at the 7-9 level.

## REPORT CARD

Overall Grade	B
General Content	B+
Presentation	B-
Pedagogy	B
Teacher Usability	B
Used Oil	A-

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"Valuable resource guide for oil recycling."  
Six lessons are provided at the middle school level.

### Pedagogy

"[Lab activities] follow the scientific method."

### Teacher Usability

"Great background information and lessons are written at a grade appropriate level."

### Specific Content

Emphasis is upon the collection and use of used oil, not the chemistry of oil. From the perspective of used oil, it is comprehensive. Some of the information is specific to Florida.

## USED OIL AWARENESS



LESSON PLAN MS-1

<b>GRADE LEVEL</b>	Middle School
<b>TYPE</b>	Group Activity
<b>TIME</b>	50 minutes (one class period)
<b>OBJECTIVES</b>	Students will determine their awareness level of used oil disposal.
<b>PREPARATION/MATERIALS</b>	Sealed oil specimens, paper, pencil and worksheets.
<b>METHOD</b>	<ol style="list-style-type: none"> <li>1. Pass the two sealed specimens of oil among the students.</li> <li>2. After student observations, discuss and list in the observation chart the characteristics of each jar.</li> <li>3. From the characteristics, ask students to identify the substance.</li> <li>4. Discuss how we know what to do with the clean oil.</li> <li>5. Discuss what should be done with the used oil. Do NOT tell the students that improper disposal of used oil is considered hazardous to the environment.</li> <li>6. Brainstorm and discuss the students' ideas on how they have observed used oil being disposed of or how THEY would dispose of used oil. Encourage students to suggest ideas even though they are probably unfamiliar with proper disposal methods.</li> <li>7. From the disposal ideas, set up a survey chart.</li> <li>8. Survey the class and plot results on the survey graph.</li> </ol>
<b>EVALUATION</b>	<ol style="list-style-type: none"> <li>1. The following discussion questions may be referenced to the lab sheet handouts:                             <ol style="list-style-type: none"> <li>a. What do our data indicate is the most common method for disposal of used oil?</li> <li>b. Hypothesize the most environmentally sound method of used oil disposal.</li> </ol> </li> </ol>
<b>EXTENSION ACTIVITY</b>	The data survey can be extended outside the classroom. Students should interview at least five individuals, record the responses and share the results with the rest of the class. Graph and discuss the results of used oil disposal.

## USED OIL AWARENESS



WORKSHEET #1 FOR LESSON PLAN MS-1

NAME \_\_\_\_\_  
SECTION \_\_\_\_\_ DATE \_\_\_\_\_

### OBSERVATION CHART

JAR A	JAR B

### SURVEY CHART


# Put Used Oil in Its Place

Utah Department of Environmental Quality  
Division of Solid and Hazardous Waste  
P.O. Box 144880  
Salt Lake City, UT 84114  
(801) 538-6170

No charge. 1995. 38 p.

*Put Used Oil in Its Place* is designed to introduce students in grades 6-12 about various aspects of used motor oil, including its proper management and the consequences of its improper disposal. Teacher background material is followed by five lessons entitled Oil and Water, Why Oil and Water Don't Mix, Changing the Way You Change Your Oil, Slipping up on Used Oil, and Getting the Word out about Used Oil. An extensive glossary is also provided. Report card scores are directed at the 7-9 level.



## REPORT CARD

Overall Grade	B
General Content	B
Presentation	B-
Pedagogy	B
Teacher Usability	B
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Driver's Education					

## COMMENTS

### General Content

"Good basic information on changing and recycling oil properly."  
"Relatively thorough."

### Presentation

"Illustrations and student handouts are needed!"

### Pedagogy

"Lesson plans are written at grade level."

### Teacher Usability

"Good background information on aspects of used oil."  
"Good reference books for teaching about oil in high school driver's education classes."

### Specific Content

"Interesting facts about what is in oil (additives)."



# Why Oil & Water Don't Mix

Preparation Time: Easy-To-Do Moderate Extensive

Grade: 6-12

Focus: Waste and water, used oil and water pollution, used oil recycling

Subject: Science (Biology), Chemistry, Auto Shop

Materials: See list of materials itemized below

Teaching Time: One class period

Vocabulary: Aquifers, groundwater, plankton, oil recycling

## Learning Objective

Students will:

- learn why it is important to recycle used motor oil to prevent it from polluting.

## Background

Many of us are concerned with the damage done when a supertanker has an oil spill. Few of us however, realize the environmental impact of our own waste management practices.

- Used automotive oil is the single largest source of oil pollution (more than 40 percent) in our nation's waterways. Most is dumped by people who change their oil.
- In 1960 service stations performed 90 percent of automotive oil changes. Today, about 60 percent of all Americans change their



During the Persian Gulf War the various tanker spills amounted to the worst spill since 1978. These tankers spilled 420 million gallons of oil.  
Source: Oil Spill Intelligence Report 1993  
1994 Environmental Almanac

own automotive oil.

- During engine use, oil picks up toxic contaminants, carcinogens, and heavy metals (lead, zinc, arsenic, chromium, and cadmium). If used oil is not properly recycled, these toxics can enter the environment.
- One pint of oil can produce a slick of about one acre on surface water.
- Fish, waterfowl, insects, and aquatic life are threatened by used oil in waterways. Floating plankton and algae (a basic food source) are killed by oil.
- Very small amounts of oil rinsed over shellfish beds can ruin the taste of clams and oysters. Less than 300 parts per million can spoil the taste of fish.
- Used oil thrown out in the garbage may seep through the landfill to contribute to leachate and contamination of groundwater.
- One quart of oil can foul the taste of 250,000 gallons of water.
- Used oil can be re-refined into new lubricating oil. (This re-refined oil is suitable for many applications.

Before using re-refined oil in your car, check the owner's manual.) Oil never wears out, it just gets dirty.

- It takes 42 gallons of crude oil to produce 2 1/2 quarts of lubricating oil. But just one gallon of used oil can be re-refined into 2 1/2 quarts of lubricating oil.
- Used oil can be reprocessed into a fuel oil.
- One gallon of used oil reprocessed for fuel contains about 140,000 BTUs of energy and can be burned efficiently.
- To recycle used automotive oil, take it in a clean, sturdy, plastic or metal container with a screw-on lid to the nearest participating recycling center or service station accepting used oil.

For oil recycling locations call the Utah Department of Environmental Quality's toll-free Hotline 1-800-458-0145.

The used oil collected for recycling cannot be contaminated. Used oil should never be mixed with antifreeze, gasoline, paint thinner, solvents, cooking oil, or other contaminants, since these interfere with reprocessing and may make the used oil hazardous.

## Materials

- A small quantity (a film canister) of either used or new motor oil, lycopodium powder, or sifted flour
- Red tempera poster paint (water based)/or food coloring
- One glass bowl
- One eye dropper
- One funnel
- Very fine aquarium or parakeet gravel or sand (natural color)
- One quart or gallon jar

- One measuring cup
- Water

## Questions for the Class

1. When you change motor oil, what should you do with it? What should you *not* do with it? Why?
2. How much crude oil does it take to make 2 1/2 quarts of lubricating oil?
3. How much used oil can be re-refined to make 2 1/2 quarts of lubricating oil?
4. How large an oil slick can one pint of oil produce?
5. What is groundwater? What is the difference between surface water and groundwater?
6. Used automotive oil contributes what percentage to the total oil pollution of our nations waterways?

## Learning Procedure

Note: You may want to substitute sifted flour or lycopodium powder or chalk dust for oil in steps 1 and 2 of the learning procedure.

1. Review with the class the background information with this lesson and the additional information in the Resource section.
2. Have students follow along as you demonstrate how oil reacts on surface water and with groundwater.

## Surface Water Demonstrations

Fill the glass bowl with water. Place several drops of used oil or lycopodium powder on the surface. Note how the oil spreads across the surface in a thin film. Ask: What would happen to marine or freshwater surface organisms like plankton and insect larvae in this water? (Oil interferes with the life cycle of

# Student and Teacher Guide to Recycling Used Oil

Pennsylvania Used Oil Recycling Information Center  
Division of Municipal and Residual Waste  
P.O. Box 8472  
Harrisburg, PA 17105  
(717) 787-7581

No charge. 1992. 77 p.

Designed for grades 7-12, the *Student and Teacher Guide to Recycling Used Oil* provides an overview of the used oil recycling process, beginning with an explanation of the crude oil cycle and concluding with a discussion of the reuse of recycled used oil. After a comprehensive teacher background section, the lesson plans, organized by grade-group level and special interest (driver's education) are presented. Step-by-step procedures for changing and disposing of motor oil are also provided. Report card scores are directed at the 7-9 level.



## REPORT CARD

Overall Grade	B
General Content	B
Presentation	B-
Pedagogy	B
Teacher Usability	B
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Driver's Education					

## COMMENTS

### General Content

"The content of this curriculum matches that of Florida's *Used Oil Recycling*."

### Presentation

"Good graphics."

"Student packet has too much text and not enough visuals."

### Pedagogy

"Very technical for 7th and 8th grade students."

### Teacher Usability

"Good background information."

### Specific Content

"Only includes three lessons for middle school. It is written for Pennsylvania teachers and some of the background information is specific to that region."

EFFECTS OF USED OIL

GRADE LEVEL Middle School

TYPE Lab

TIME 50 Minutes (one class period)

OBJECTIVES Students will describe the effects of used motor oil on the environment

PREPARATION/ Two 2-liter jars (clear), water, sand or soil, live

MATERIALS plants, used motor oil or vegetable as alternative, and worksheets.

- METHOD
1. Distribute lab sheets.
  2. Perform Experiment. Guidelines for experiment are found on the following page.
  3. Record observations.
  4. Discuss observations.
  5. Turn in lab sheet.

GUIDELINES FOR EXPERIMENTPROCEDURE

1. Set two 2-liter jars on table.
2. Fill each with water, sand, and plants.
3. Develop and record hypothesis on lab sheet. In other words, what do you think will happen, and why?
4. Drop used motor oil (one dropper full) onto water surface of one jar only. Label this jar "A." Label the other jar "B." Jar B will be the control jar.
5. Observe and record on lab sheet.
6. Create a disturbance on both jars (A + B) to stimulate natural movement on water (storms, boats, etc).
7. Observe and record findings on lab sheet.
8. Remove plants and sample of sand from each jar being careful to keep each separate from the other and avoiding contamination of one with the other.
9. Observe and record results on lab sheet. Look, touch, and smell but DO NOT TASTE!
10. Record results and conclusions based on hypothesis.

# Earth Resources - A Case Study: Oil

California Integrated Waste Management Board  
Public Education and Assistance Section  
8800 Cal Center Drive, Mail Station #5  
Sacramento, CA 95826  
(916) 255-2385



No charge to California educators who participate in a workshop. 1998. 534 p.

**Designed as a nine to twelve week unit,** *Earth Resources - A Case Study: Oil* enables ninth and tenth grade students to explore scientific concepts and environmental issues associated with the management of natural resources, using a case study of motor oil. Upon completion of a workshop, teachers receive the Earth Resources curriculum kit that includes the curriculum binder, video, posters, information booklets, and laboratory materials used in student investigations. Lessons are organized in four sections: Locating, Acquiring, and Processing Our Earth's Resources, Using Our Earth Resources, Disposing of Our Earth's Resources, and Reducing, Reusing, and Recycling Our Earth Resources. Report card scores are directed at the 7-9 level.

## REPORT CARD

Overall Grade	A-
General Content	A-
Presentation	A-
Pedagogy	A-
Teacher Usability	A-
Used Oil	A

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"It's so complete - background information, conceptual framework, pedagogy!"  
"Quite comprehensive. Activities cover a wide range for science classroom use."

### Presentation

"A friendly format."

### Pedagogy

"Some lessons are constraining and may need to be more open-ended."  
"A rich resource. The students' conceptual understanding is clear and instructional strategies effectively directed."

### Teacher Usability

"A very clean, concise curriculum; well organized and easy to use."  
"Detailed crib notes provides directions for each lab."  
"Good assembly of hard to find resources."

### Specific Content

A comprehensive used oil curriculum.  
"A complete treatment of oil (geology, chemistry, etc.)"

## What to Do With Used Oil? *The Trash Can*

### LESSON CONCEPT

A change in one part of the ecosystem has consequences for other parts of the ecosystem.

### LESSON OVERVIEW

Students investigate the advantages and disadvantages of a common, yet hazardous and illegal, method of used motor oil disposal. Students analyze the environmental impact of discarding used motor oil in a landfill. Students determine how used motor oil travels through a model of a landfill.

### SECTION 3:

#### Disposing of Our Earth's Resources

##### Section Concepts

**Human:** Materials from human societies affect both physical and chemical cycles of the Earth.

**Scientific:** Because ecosystems are interdependent, a change in one system may have far-reaching effects on the others.

### DESIRED OUTCOMES

Students will:

*Predict* how a single component of a system might interact with other components in various ways. Students will *explain* how used oil, with its contaminant substances, might leach into groundwater through a landfill.

*Explain* the environmental impact caused by the disposal of a used natural resource into a landfill. Students will *analyze* the environmental impacts that can occur when used oil and its contaminants are discarded in a landfill.

*Generalize* that natural systems have the capacity to reuse water, but the capacity is limited. Students will *evaluate* the basis for California Health and Safety Code 25250.5 and the legal methods of disposal of used oil and its contaminants.

Students will use the following scientific thinking processes:

*Observing, communicating, relating, inferring, and applying.*

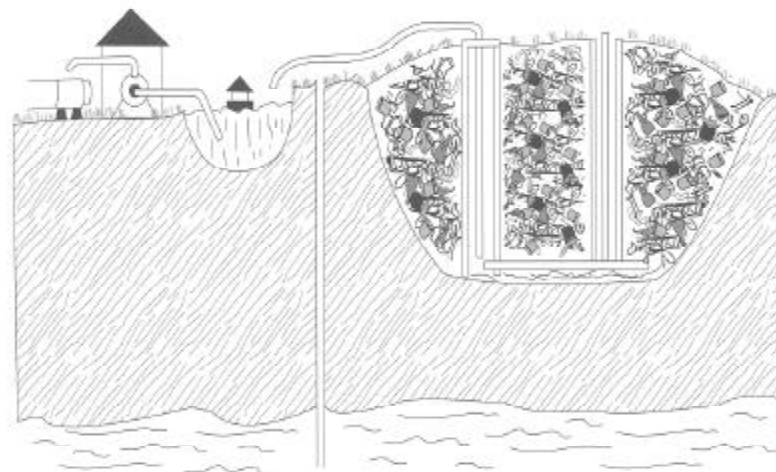
### STEPS FOR TEACHING

Teacher Action	Student Action	Suggested Time
Investigate students' prior knowledge about disposing of used oil in soil and in landfills.	<i>Examining Prior Ideas</i>	20 min.
Guide and assist students in constructing a model landfill and observe the changes in water quality as a contaminant passes through the landfill.	<i>Processing Information; Investigating</i>	55 min.
Ask students to speculate what the environmental impact is if many people dispose of used oil in the trash.	<i>Applying Knowledge</i>	35 min.
Instruct students to write a fact-based reply about the impact of used oil disposal in landfills.	<i>Reflection</i>	

Name: \_\_\_\_\_ Date: \_\_\_\_\_



## A Model Landfill Diagram



Using the terms below, label the parts of this landfill. Describe your understanding of the landfill parts on the lines provided.

Cap: \_\_\_\_\_

Gas Recovery System: \_\_\_\_\_

Refuse: \_\_\_\_\_

Composite Liner System: \_\_\_\_\_

Groundwater Monitoring Well: \_\_\_\_\_

Groundwater: \_\_\_\_\_

Leachate Collection System: \_\_\_\_\_

Leachate Treatment System: \_\_\_\_\_

# Oil's Well That Ends Well

City of Fremont  
Environmental Services Division  
39550 Liberty Street, PO Box 5006  
Fremont, CA 94537-5006  
(510) 494-4740



Price to be determined. 1997. 90 p.

This secondary level curriculum is designed to increase students' awareness of the issues surrounding used motor oil. Oil is examined as a finite natural resource requiring conservation and safe handling. Three lessons are offered in each of the four modules. Module I focuses are the origin of oil, Module II deals with the oil refining process and proper disposal of used oil, Module III studies the consequences of improper disposal of used oil and importance of used oil recycling, and Module IV provides tools to help students find solutions to the used motor oil problem. Report card scores are directed at the 10-12 level.

## REPORT CARD

<b>Overall Grade</b>	<b>B+</b>
<b>General Content</b>	<b>B+</b>
<b>Presentation</b>	<b>B+</b>
<b>Pedagogy</b>	<b>B+</b>
<b>Teacher Usability</b>	<b>A-</b>
<b>Used Oil</b>	<b>A</b>

<b>DISCIPLINE</b>	<b>EMPHASIS</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"A clear, concise manual about oil awareness."

### Presentation

"Graphics help describe the processes."

### Pedagogy

"Nice hands-on experiments."

### Teacher Usability

"It is divided into modules and lessons that can either stand alone or be integrated into an existing curriculum."

"Easy to follow instructions."

"Good background information, although some of the activities are weak."

### Specific Content

"A thorough look at oil from 'cradle to grave'."

"Highly appropriate for auto shop and other vocational education courses."

# UNDERSTANDING USED OIL

## LESSON 5

### LESSON SUMMARY:

Students will develop a comparative rating chart of motor oil sold in the automotive stores under various brand names.



#### Key Concept:

Re-refined oil has to meet the same quality standards as refined oil.



#### Subjects:

Auto Shop, English, Science



#### Time:

One class period



#### Materials:

- Samples of refined oil in original containers
- Samples of re-refined oil in original containers
- A few empty transparent glass or plastic bottles
- Motor Oil Comparison Chart (see page 39)

### Background:

There are many myths surrounding used oil and re-refined oil that unless we dispel those myths, they will continue to hinder the process of education. Unless we are informed about the facts related to used oil and re-refined oil, we will not be motivated to successfully recycle oil or buy recycled oil. Below is a list of some of the myths surrounding used oil:

- Used oil is contaminated and can never be reused.
- Re-refined oil damages the car engine.
- Re-refined oil can not be as good as refined oil.
- Re-refined oil is more expensive.
- Re-refined oil can not meet the same standards as refined oil.

In reality, used oil can be recycled many times. When oil gets used, it only gets dirty and, like our laundry, it can be cleaned and used over and over again. If you recycle used oil at the curbside or at a recycling center, it gets shipped to a refinery that handles used oil. Once crude oil is refined, it is known as refined oil. When refined oil gets used, it is called used oil. When used oil gets refined again, it is called re-refined oil. At a refinery,

when oil gets re-refined, it goes through chemical processes to remove its contaminants. Re-refined oil that gets sold in the market has to meet the same standards as refined oil. Re-refined oil is as good for your car engine as refined oil. When you buy re-refined oil, you are helping in closing the recycling loop. Of the 1.3 billion gallons of



Re-refined Issues\Module 11

39

### Understanding Used Oil



## Student Worksheet

### Motor Oil Comparison Chart

Date: \_\_\_\_\_  
Name: \_\_\_\_\_  
Number of Samples: \_\_\_\_\_

Brand Name of Oil	Type of Oil/SAE Rating	API Rating	Other Rating	Visual Characteristics (color, viscosity, etc.)	Cost	Is it made from re-refined oil?	Is the oil container recyclable?	Other Notes (indicated on the label)
ABC company	SAE 20W-50	API Service SJ		Light Brown, Thickest among all the 5 oils compared	\$3 for one quart	Does not indicate on the label	Yes. HDPE plastic, has #2 in the three recycling arrows, can be recycled in Fremont.	Has anti-oxidants, detergents, dispersants, and varnish inhibitors that provide protection against thermal breakdown.

39

Re-refined Issues\Module 11

USED OIL

# Action for a Cleaner Tomorrow

South Carolina Department of Health and Environmental Control  
2600 Bull Street  
Columbia, SC 29201  
(800) 768-7348



No charge. 1998. 619 p.

Revised in 1998, *Action for a Cleaner Tomorrow* (grades 6-12 edition) address numerous issues including the environmental effects of solid waste, human population growth, manufacturing by-products, excessive packaging, and motor oil. Lessons are divided into two sections (grades 6-8 and 9-12) and are supported by an extensive resource section covering background information, glossary, and a list of books and videos. One subsection at the 9-12 grade level focuses on recycling used oil and includes lessons that detail the proper way to collect and recycle engine oil, compute the energy savings from recycling oil, and analyze the effects of mismanaged used oil. Report card scores are directed at the 10-12 level.

## REPORT CARD

Overall Grade	B
General Content	B+
Presentation	B
Pedagogy	B
Teacher Usability	B
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"Offers activities for a variety of disciplines."  
"The social sciences are well represented."

### Presentation

Since this compendium project, *Action for a Cleaner Tomorrow* has been redesigned.

### Pedagogy

"Activities could use more directed action elements."

### Teacher Usability

"Interesting, but limited background information."  
"Very clear, easy to follow."  
"Many lessons from which to draw."

### Specific Content

Covers a range of used oil issues.



## Changing the Way You Change Your Oil

Preparation Time:	Easy-to-do	Moderate	Extensive
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<b>Grade:</b>	9 - 12
<b>Focus:</b>	How to change your engine oil responsibly
<b>Subject:</b>	Driver's Training, Auto Shop, Graphic Arts
<b>Materials:</b>	10 Steps for Changing Your Oil Properly handout, Art in Communicating Used Oil Recycling transparency, art supplies to make posters
<b>Teaching Time:</b>	One class period

### Learning Objective

Students will learn how to change the oil in a car with used oil recycling as a part of the procedure.

### Background

For many decades, motorists simply took their cars to full service stations for oil changes and all routine maintenance. For those that preferred to do their own car maintenance and oil changes (do-it-yourselfers), these full service stations also sold motor oil and other car maintenance items and accepted their customers' used motor oil back as a service.

During the 1960s, motor oil marketing and distribution patterns changed radically. Service station sales gave way to sales by mass merchandisers and other retail outlets, such as Kmart and other discount chains. These retailers offered oil to their customers at greatly reduced prices as a result of large volume discounts. Many stores began using oil as a promotional item to attract customers, selling oil as a "loss leader" - an

item that is sold below cost to lure customers while the losses are made up on other items. At the same time discount houses were offering bargain prices for motor oil, many full service stations began scaling back automotive maintenance and repair services and became quick, convenience-oriented "gas stations." Most of these gas stations did not accept used oil from the general public.

In 10 years, from 1960 to 1970, service station sales of motor oil dropped from 70 percent of all sales to about 50 percent. By 1989, mass marketing retail stores outsold service stations eight to one. This left the majority of the do-it-yourselfers with the problem of disposing-of-it-yourself as well.

Today, it is estimated that do-it-yourselfers produce more than 200 million gallons of used oil nationally and, according to the American Petroleum Institute, 75 percent of this used oil is properly collected and recycled.

Mismanaged used oil represents a serious environmental problem. While each person tossing out an occasional pan of used oil might not seem like it could do any harm, it all adds up.

As much as 20 percent of automotive oil is additives. These improve performance, inhibit rust and prevent foaming. Oil will also pick up sediment and gasoline components.

### Materials

To conduct lesson for Auto Class and Driver's Training

- Facilities and materials needed to perform an oil change, including a clean, sturdy



In 1993, President Clinton established the Council on Sustainable Development to formulate U.S. policies that encourage economic growth, job creation and effective use of natural and cultural resources. The council's primary goals will be to recommend a national strategy for achieving sustainable development as outlined at the 1991 United Nations Earth Summit.

Source: State Recycling Laws Update

metal or plastic container with a screw-on top for collecting used oil and a container for the oil filter

- Information on local used oil recycling sites
- Handout 10 Steps for Changing Your Oil Properly.

To conduct lesson for Art Class

- Creative art supplies for making banners, posters and/or calendars
- Information on local used oil recycling sites
- Handout 10-Steps for Changing Your Oil Properly
- Arts in Communicating Used Oil Recycling transparency or handouts.

### Learning Procedure: For Auto Class and Driver's Training

- Review with the class the background material with this lesson and the information provided in the Resource Section. **Ask:** Why do we change engine oil? (*It gets dirty and this dirt interferes with engine performance and can damage parts.*)

Explain that oil does not wear out. What does wear out are all the engine additives that go into today's high performance motor oils.

- Demonstrate the Environmental Protection Agency's 10 Steps For Changing Your Oil Properly, see the handout with this lesson for instructions.

### Questions for the Class

- Why do we need to change engine oil?
- What should we do with used motor oil?
- What should we do with used oil filters?
- What should we do with empty motor oil bottles?
- Why is used motor oil an environmental concern?

### For Art Class

- Review with the class the background material with this lesson and the information provided in the Resource Section. **Ask:** How can we use graphic arts to help people learn to modify the way they change their oil to incorporate used oil recycling? (*Create visual reminders such as banners, posters, point-of-purchase displays and calendars to display in home garages and service stations, modify the directions on motor oil bottles, etc.*)
- Project the transparency Arts in Communicating Used Oil Recycling showing how different organizations have used visuals to communicate their used oil recycling messages. Discuss how these images might be effective.
- Have students design their own used oil recycling graphics and complete a project such as:

- A poster to hang in a home garage appealing to a family with the message of used oil recycling;
- A calendar to remind people to change their oil at regular intervals and to dispose of it properly;
- A banner to hang in the school auto shop to promote used oil recycling;
- A brochure on the environmental responsibilities of owning and maintaining a car aimed at first-time drivers;
- An ad for the school paper promoting used oil recycling.

For all the graphics arts projects, it is useful to include local information on used oil recycling sites. Encourage students to complete finished quality projects and arrange to have them displayed.

### Extension Activity

Share with the class the information in the article, "Driving Green," from the *Green Consumer*.

# Used Oil Recycling, A Complete Curriculum

Florida Department of Environmental Protection  
Hazardous Waste Management Section  
2600 Blair Stone Road  
Tallahassee, FL 32399-2400  
(850) 488-0300



\$256.00 per kit. 1990. 115 p. teacher's guide.

Product is of limited availability. Permission is granted to educators to reproduce lesson plans for classroom use, provided credit is given to FDEP.

Designed for 7-12 grades, *Used Oil Recycling, A Complete Curriculum* offers a video, poster, used oil display, and teacher's guide with background information, transparency masters, student guide, and lesson plans organized by grade-group level. The material provides an overview of the used oil recycling process, including the formation, drilling, and refining of crude oil, economic and environmental issues of disposal practices, and the collection, transportation, reclamation, and reuse of used oil. Report card scores are directed at the 10-12 level.

## REPORT CARD

Overall Grade	B-
General Content	B-
Presentation	B-
Pedagogy	B-
Teacher Usability	B-
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### Presentation

"Layout needs improvement."

"Nice visuals of the properties of new versus used oil."

### Pedagogy

"While the content is factual, lessons do not offer opportunities for analytical thinking on the part of the student."

### Teacher Usability

"The resources and data mentioned need to be updated. EPA 'regs' have changed."

### Specific Content

"Thorough and specific in the treatment of used oil as both a resource and waste product."

# INVESTIGATING USED OIL



LESSON PLAN HS-5

<b>GRADE LEVEL</b>	High School
<b>TYPE</b>	Student Worksheet
<b>TIME</b>	150-170 minutes (3-4 class periods)
<b>OBJECTIVES</b>	Students will: <ol style="list-style-type: none"> <li>1. List examples of how used oil affects ecosystems</li> <li>2. Describe strategies an individual can use to conserve critical non-renewable resources by recycling used oil.</li> <li>3. Identify actions that can affect environmental quality.</li> <li>4. Suggest possible solutions to problems related to disposal of used oil.</li> <li>5. Interpolate and/or extrapolate conclusions when given appropriate data and/or graphs.</li> <li>6. Use science process skills to analyze information from public media.</li> </ol>
<b>PREPARATION/MATERIALS</b>	Audio-visual program included in this kit, student guide, student worksheets, markers, poster board or paper.
<b>METHOD</b>	<ol style="list-style-type: none"> <li>1. Have students conduct a survey of 4-5 people per student using the survey worksheet.</li> <li>2. Graph class survey results on board and discuss implications.</li> <li>3. Use audio-visual program following discussion of survey results.</li> <li>4. (OPTIONAL) Guest speaker presentation addressing used oil generation, collection, recycling and regulation in your area.</li> <li>5. Have students review guide.</li> <li>6. Students work individually or in groups to create posters or flyers aimed at increasing public awareness of and participation in used oil recycling.</li> </ol>
<b>EVALUATION</b>	<ol style="list-style-type: none"> <li>1. Students will write and justify instructions that one would follow to handle used oil.</li> <li>2. Students will complete a flyer or poster with accurate information to encourage the public to handle used oil properly.</li> </ol>

VALENCIA COMMUNITY COLLEGE

52

DEPARTMENT OF ENVIRONMENTAL REGULATION

# INVESTIGATING USED OIL



WORKSHEET #1 FOR HS-5

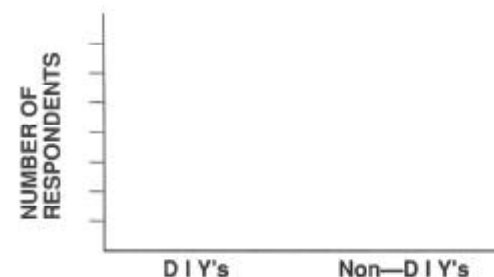
NAME \_\_\_\_\_  
SECTION \_\_\_\_\_ DATE \_\_\_\_\_

## I. SURVEY SHEET

1. Do you change your own oil in your car?
2. (a) If YES, what do you do with the used oil?  
  
(b) If NO, then do you know what happens to the used oil after it is collected from your car?
3. What effects do you think the methods of disposal outlined in question 2 might have on the environment?

## II. COMPLETE THE FOLLOWING

1. Construct a bar graph using the data gathered from the above survey.



2. What percentage of your respondents are DIY's? \_\_\_\_\_
3. Extrapolate your data to county-wide levels by working the following formula:

$$\frac{\text{county population}}{\text{survey \% DIY}} \times \text{survey \% DIY} = \text{approximate county DIY population}$$

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54

DEPARTMENT OF ENVIRONMENTAL REGULATION

# Put Used Oil in Its Place

Utah Department of Environmental Quality  
Division of Solid and Hazardous Waste  
P.O. Box 144880  
Salt Lake City, UT 84114  
(801) 538-6170



No charge. 1995. 38 p.

*Put Used Oil in Its Place* is designed to introduce students in grades 6-12 about various aspects of used motor oil, including its proper management and the consequences of its improper disposal. Teacher background material is followed by five lessons entitled Oil and Water, Why Oil and Water Don't Mix, Changing the Way You Change Your Oil, Slipping up on Used Oil, and Getting the Word out about Used Oil. An extensive glossary is also provided. Report card scores are directed at the 10-12 level.

## REPORT CARD

Overall Grade	B-
General Content	B-
Presentation	B-
Pedagogy	B-
Teacher Usability	B
Used Oil	B+

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### General Content

"A quick and straightforward 'unit' on recycling used oil."

### Pedagogy

"Activities demonstrate principles."

### Teacher Usability

"It consists of five activities - probably suitable for auto shop students only."  
"Though short and simple, the activities are thorough and would be very easy to implement."

### Specific Content

"Although written for Utah, it is completely usable elsewhere."

# Changing the Way You Change Your Oil

Preparation Time: Easy-To-Do Moderate Extensive

**Grade:** 6-12

**Focus:** How to change your engine oil responsibly

**Subject:** Drivers Training, Auto Shop, Graphic Arts

**Materials:** *10 Steps for Changing Your Oil Properly* handout, art supplies to make posters

**Teaching Time:** One class period

## Learning Objective

Students will:

- learn how to change the oil in a car with used oil recycling as a part of the procedure.

## Background

For many decades, motorists simply took their cars to full service stations for oil changes and all routine maintenance. For those that preferred to do their own car maintenance and oil changes (do-it-yourselfers), these full service stations also sold motor oil and other car maintenance items and accepted their customers' used motor oil back as a service.

During the 1960's, motor oil marketing and distribution patterns changed radically. Service station sales gave way to sales by mass merchandisers and other retail outlets, such as Kmart and other discount chains. These retailers offered oil to their customers at greatly reduced prices as a result of large volume discounts.



The Exxon Valdez oil spill in 1989 killed 350,000 to 390,000 seabirds, according to the General Accounting Office report to Congress.  
1993 Environmental Almanac

Many stores began using oil as a promotional item to attract customers, selling oil as a "loss leader" an item that is sold below cost to lure customers while the losses were made up on other items. At the same time discount houses were offering bargain prices for motor oil, many full service stations began scaling back automotive maintenance and repair services and became quick, convenience-oriented "gas stations." Most of these gas stations did not accept used oil.

In 10 years, from 1960 to 1970, service station sales of motor oil dropped from 70 percent of all sales to about 50 percent. By 1989, mass marketing retail stores outsold service stations eight to one. This left the majority of the do-it-yourselfers with the problem of disposing-of-it-yourself as well.

Today, it is estimated that do-it-yourselfers dispose of some 210 million gallons of used oil improperly. (Some sources say more than 300 million gallons is a better estimate.)

This mismanaged used oil represents a serious environmental problem. Do-it-yourselfers dump the equivalent of about 14 Exxon Valdez spills each year - that's about 143 million gallons of used oil that ends up contaminating our land and our water.

While each person tossing out an occasional pan of used oil might not seem like it could do any harm; it all adds up.

As much as 20 percent of automotive oil is additives. These improve performance, inhibit rust, and prevent foaming. Oil will also pick up sediment and gasoline components.

## Materials

*To conduct lesson for Auto Class and Driver's Training*

- Facilities and materials needed to perform an oil change, including a clean, sturdy metal or plastic container with a screw-on top for collecting used oil and a container for the oil filter
- Information on local used oil collection centers
- Handout *10 Steps for Changing Your Oil Properly*

*To conduct lesson for Art Class*

- Creative art supplies for making banners, posters, and/or calendars
- Information on local used oil recycling stations
- Handout *10 Steps for Changing Your Oil Properly*

## Learning Procedure

*For Auto Class and Drivers Training*

- Review with the class the background material with this lesson and the information provided in the Resource section. **Ask:** Why do we change engine oil? (*It gets dirty and this dirt interferes with engine performance and can damage parts.*)

Explain that oil does not wear out, what does wear out are all the engine additives that go into today's high performance motor oils.

- Demonstrate the Environmental Protection Agency's *10 Steps For Changing Your Oil Properly*, see

handout with this lesson for instructions.

## Questions for the Class

- Why do we need to change engine oil?
- What should we do with used motor oil?
- What should we do with oily rags and used oil filters?
- Why is used motor oil an environmental concern?

*For Art Class*

- Review with the class the background material with this lesson and the information provided in the Resource section. **Ask:** How can we use graphic arts to help people learn to change the way they change their oil to incorporate used oil recycling? (*Create visual reminders such as banners, posters, point-of-purchase displays, and calendars to display in home garages and service stations, modify the directions on motor oil bottles, etc.*)
- Have students design their own used oil recycling graphics and complete a project such as:
  - A poster to hang in a home garage appealing to a family message of used oil recycling.
  - A calendar to remind people to change their oil at regular intervals and to dispose of it properly.
  - A banner to hang in the school auto shop to promote used oil recycling.
  - A brochure on the environmental responsibilities of owning and maintaining a car aimed at first-time drivers.
  - An ad for the school paper promoting used oil recycling.

For all the graphics arts projects, it is useful to include local information on used oil collection centers. Encourage students to complete finished quality projects and arrange to have them displayed.

# Student and Teacher Guide to Recycling Used Oil

Pennsylvania Used Oil Recycling Information Center  
Division of Municipal and Residual Waste  
P.O. Box 8472  
Harrisburg, PA 17105  
(717) 787-7581



No charge. 1992. 77 p.

Designed for grades 7-12, the *Student and Teacher Guide to Recycling Used Oil* provides an overview of the used oil recycling process, beginning with an explanation of the crude oil cycle and concluding with a discussion of the reuse of recycled used oil. After a comprehensive teacher background section, lesson plans, organized by grade-group level and special interest (driver's education) are presented. Step-by-step procedures for changing and disposing of motor oil are also provided. Report card scores are directed at the 10-12 level.

## REPORT CARD

Overall Grade	B-
General Content	B-
Presentation	B-
Pedagogy	B-
Teacher Usability	B-
Used Oil	B

DISCIPLINE	EMPHASIS	0	1	2	3
Science					
History/Social Science					
Health					
Mathematics					
Visual/Performing Arts					
Language Arts					
Industrial/Vocational Ed.					
Foreign Language					

## COMMENTS

### Presentation

Format is in need of improvement.

### Pedagogy

"This piece needs more opportunities for applied thinking."

"Dramatic activities! I like the 'How to Change Your Own Oil' lesson."

This curriculum could be used in a driver's education class.

### Specific Content

Specific oil issues that are addressed include the recycling of used motor oil, oil as a non-renewable resource, and the environmental impact of improper disposal.

# POLLUTION NEVER GOES AWAY

GRADE LEVEL High School

TYPE Lab

TIME 50 minutes (1 class period)

OBJECTIVES Students will demonstrate that pollution does not disappear but only changes form or location. The instructor should show how this relates to used oil.

PREPARATION/MATERIALS Four 100 ml beakers, one funnel, one piece of filter paper, water, 100 ml of rubbing or isopropyl alcohol, 20 ml of methylene blue dissolved in one liter of water, one tsp. (5 ml) of activated carbon or charcoal (fish tank charcoal), worksheets.

- METHOD
1. Fold filter paper in half and then in half again. Open filter to form a cone that fits snugly into the funnel.
  2. In one 100 ml beaker, combine 1 tsp. (5 ml) of charcoal and 20 ml of methylene blue solution. Swirl beaker gently until liquid is colorless (if solution does not clear, add one-half tsp. of charcoal).
  3. Transfer liquid and charcoal to the filter paper in the funnel. What can be deduced from observing the solution before and after the addition of the charcoal? What can be inferred about the charcoal at this point? pH could be checked in the various solutions. Methylene blue is not affected over the pH range of 1- 12.

4. Allow all of the liquid to drain from the filter, then add 20 ml of water to the filter to rinse the charcoal. Allow all of the water to drain from the charcoal. Did the rinse water have any color?
5. Transfer charcoal to the 100 ml beaker.
6. Add 10 ml of alcohol to the beaker containing the charcoal.
7. Swirl and decant the alcohol phase.
8. Add 50 ml of alcohol to the beaker with the charcoal and swirl to mix the alcohol and the charcoal. Note the color of the liquid phase. There should be a light blue tinge in the liquid after a few minutes of mixing. This demonstrates that the methylene blue was absorbed into the charcoal.

EVALUATION Student worksheet submitted for grade.

MATERIALS Four 100 ml beakers, 1 funnel, 1 piece of filter paper to fit funnel, water, 100 ml of isopropyl alcohol, 20 ml of methylene blue solution, 1 tsp. (5 g) of activated charcoal (fish tank charcoal may be used).